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NORMAL LOGIC OR THE SCIENCE OF ORDER

I. WHAT IS LOGIC?

UNDER certain conditions all men think alike; judgments and inferences are universal. "Where there is smoke there is fire," is an inference arrived at in precisely the same way, and with precisely the same result, no matter whether the thinker is a cowboy or a philosopher. Yonder on the wooded hillsides rises the gray vapor, and we know at once that a fire has been kindled.

What is the ground of this unanimous conclusion? Is it instinct? Many logicians would answer in the affirmative. They might, perchance, even stigmatize it as *blind instinct.* "Common-sense deduction probably moves by blind instinct." (A. N. Whitehead: *The Organization of Thought,* p. 127.) "The natural behavior of men, as of other animals, is not logical, but instinctive." (R. C. Lodge: *Modern Logic,* p. 1.)

Are common-sense conclusions a matter of heredity? Again we get affirmative answers. "The main outlines of life are fixed in the main by inherited racial tendencies." (R. C. Lodge: *Modern Logic,* p. 1.)

Other logicians would say that common-sense conclusions are intellectual rather than instinctive. They might even hint that the superior pose, intellect *versus* instinct, affected by some authors towards ordinary mortals, is merely a bit of priggishness. But suppose that we, for the sake of argument, grant the instinctive solution. It may enlarge our conception of instinct and heredity to an extent such that we, after all, may approximate the intellectual solution.

We shrewdly suspect that there is something deeper than instinct, deeper than heredity, at work to produce this remarkable harmony of thought in minds so diverse in native endowments and acquired culture. We want to go a bit below the surface and see if there is not some profound reason for common-sense behavior. It may be in some sense both instinctive and hereditary, but is that the

end of the matter? Is it to be summarily excluded from further consideration by the logician?

The basis of instinct is cosmic order. Cosmic organization consists in an intricate network of constant relations, such, for instance, as the familiar dyad relation, smoke—fire. Instinct—or intellect, whichever it may be that is at work in common-sense mental activity—acts in harmony with these constant relations. Such action implies a definite type of nervous structure, and this is propagated from generation to generation. Thus inference may be, in a liberal sense of the terms, both instinctive and hereditary; but all the same it is its solid basis in cosmic order that makes it uniform in all minds.

But is common-sense inference logical? The authors cited above evidently mean that instinctive hereditary thinking is not logical. "Not logical, but instinctive," is their verdict. They urge us to become logical by deliberate choice and determined perseverance. "The value of cultivating such a mental attitude is beyond question." (R. C. Lodge: *Modern Logic,* p. 3.) Just as if any sane mortal could help being logical. The cosmos is logical, and its objective control settles the matter for us out of hand. This, of course, is not to deny the unquestionable value of *improving* the inborn logical faculty, bringing more clearly into consciousness its nature and its guiding principles.

We need to enlarge our conception of what is logical. When we characterize a given treatise or discourse as logical, what do we mean? Certainly not that it is cast in syllogistic form. We mean that it is clear, cogent, coherent, well arranged, orderly. Logic is the science of order. And order is cosmic in its range and influence. Sane thinking is logical thinking not simply because we want it to be logical. It is not ultimately governed by human desire or caprice. It is logical because the universe is logical, and we think—so long as our thinking is normal—in harmony with the environment. And by the environment we mean not merely the material universe but the whole universe, including both mind and matter. Whether or not the cosmos included a mental element from the beginning, it certainly does now include mind. And its constituent parts are not at war; they blend and harmonize. Not only are we in the cosmos; the cosmos is in us. The mental world, so long as it is normal, is no less orderly than the external world. The stars in their courses tell the story of cosmic order; they "sing together" as in the creation. And the mental world responds in sympathy; "deep answers unto deep." The notes of harmony in the material universe are matched with answering strains within—unless, as sometimes happens, the latter are "like sweet bells jangled, out of tune." Our normal thinking flows in orderly channels to reach sure and sane conclusions because

both mind and matter are shot through with the same systematic texture. Cosmic order is internal as well as external. Logical thinking is clear, sure, goes straight to the point, because it is the thought of a sane thinker in a sane world, not a world of chance. This, of course, is not to say that all human thinking is sound and valid. But when it does fall short of the logical ideal, that is because we misconstrue or misapply some item of cosmic organization.

Defining logic as the science of order is more comprehensive than the old definitions. It links logic with the orderly cosmos, bases it upon the *norms*[1] of cosmic order, thus giving it an objective as well as a subjective reference. For these norms are both objective and subjective; they are bedded in the structure of the material universe and also in the constitution of the human mind. This gives normal logic a just balance as between objective and subjective control. The old logic is too exclusively subjective, too anthropocentric. The familiar definition, "Logic is the science of reasoning," referred exclusively to human reasoning. "Logic is the science of the laws of thought," referred to the ways in which *men* think, ignoring the objective control of cosmic order. A clear example of the old anthropocentric point of view is the following remark of Baldwin in his Dictionary of Philosophy, Vol. II., p. 21.

"It is true that the contemplation of a state of things believed to be real may cause the contemplator to believe something additional without making any classification of such sequences.[2] But in that case he does not criticize the procedure, nor so much as distinctly reflect that it is just. He can, consequently, not exercise any control over it. Now that which is uncontrollable is not subject to any normative laws at all; that is, it is neither good nor bad; it neither subserves an end nor fails to do so. But it is only the deliberate adoption of a belief in consequence of the admitted truth of some other proposition which is properly speaking reasoning."

According to this dictum logical thinking must be under subjective control. Just what that means might not be easy to determine, but at any rate it ignores—nay, it flatly denies—objective control. "That which is uncontrollable [by the thinker] is not subject to any normative laws at all." But external control is a stubborn fact; we

[1] In view of the leading rôle of the norms of cosmic order *Normal Logic* is an appropriate name for the science of order.

[2] "Classification of sequences" here refers to Baldwin's definition of logic, or its "central problem," as the "classification of arguments," a very narrow and inadequate definition. The primary and essential business of logical thinking is the *making* of judgments and inferences. Classifying them as good or bad is secondary, not as he claims the "central problem" of logic. Indeed it is not a problem at all for the original ordinary thinker; and even for the critical logician it is just one problem among many.

must think in harmony with the environment or go crazy. The insane man ignores objective control, and consequently revels in hallucinations.

The practical consequences of this dictum, if it were rigidly applied, would be far-reaching—more radical and sweeping than its author probably realized. If we sternly exclude from logic all judgments and inferences based on objective control, it would be interesting to consider just what we have left. The fundamental division of logical functions is twofold. There are, in the first place, Direct Interpretations of the Environment, first-hand judgments and inferences evoked when the thinker is confronted with a natural situation not expressed in words; for instance, vigorous puffs of steam from the spout of the kettle imply that the water is boiling. We know the "something additional" to what we see without applying a thermometer, and we are constrained to believe it on account of the constant relation between boiling and steam. It is a clear case of external control. The thinker has no power to reject the conclusion.

There are, in the second place, Verbal Implications, those logical functions characterized by "deliberate adoption of a belief in consequence of the admitted truth of some other *proposition.*" Baldwin follows traditional logic in accepting only verbal implications as logical. Direct inferences from reality, which are clearly under objective control, being thus excluded, we must inquire into the kind of control to which verbal implications are subject, if we would meet Baldwin on his own ground. The justice of excluding the first grand division of logical functions, spontaneous dyad inferences,[3] will be considered below.

For an example of verbal implication let us suppose that we have accepted as true the verbal proposition, "Arnold is a traitor." We are thereupon forced to the conclusion, "He deserves death." Here the control is of a somewhat mixed character. There is, on the one hand, human custom, possibly embodied in statute law. On the other hand there is self-preservation of the community, that "first law of nature," which demands the death of a sly enemy within the gates. Human custom has a natural sanction. But no matter whether we emphasize the human or the natural factor in this kind of control, it is in either case objective control for the individual thinker. Even the human factor in it is cosmic, for cosmic order includes humanity and includes constant relations which may be either wholly or partly of human origin, such, for instance, as the relation treason—death.

[3] *Dyad inferences* are inferences based on dyad relations, such as the simple relation A — B, or steam—boiling water. Dyad relations far outnumber the more complex relations.

Whatever of order has been evolved within the cosmos is a part of cosmic order.

The above example illustrates one kind of objective control in verbal implication—objective at least so far as the individual thinker is concerned. Another kind of objective control is necessity. All logicians recognize certain conclusions as necessary. But necessity means imperative objective control. The thinker has no option left when necessity is in the saddle.

External physical control is still another kind of objective control, and it applies both to verbal implications and spontaneous dyad inferences. In many cases the control is precisely the same no matter whether the datum is a verbal proposition or a fact directly observed. For instance, "Barometer falling—storm coming," is just the same inference, and it is under the same external control, no matter whether I get the datum by looking at the instrument or by reading the weather report. We mean that it is essentially the same, and deserves the same honorable treatment as a sound and valid piece of logical thinking, though in our fundamental classification of logical functions it is in the one case a direct interpretation of reality, and in the other case a verbal implication.

We find that verbal implications may be under objective control either of human origin or of external physical origin. Direct interpretations of reality are generally under physical control. Such being the actual status of both verbal implications and spontaneous dyad inferences, *i. e.*, they are generally under some sort of control which is objective to the individual thinker, we fear that we should have left a very beggarly scrap of logic if Baldwin's anthropocentric dictum were rigidly applied.

In order that we may not do injustice to Baldwin, an author whose ability is freely recognized at home and abroad, we quote the following from the Glossary of Terms in his *Genetic Theory of Reality*, p. 315.

"*Control:* the limiting, directing, regulative (as over against the constitutive) factor in the determination of anything.

"Illustrations: the determination of a physical object has the external control afforded by sensations of resistance; that of ends, goods, objects of desire, has the inner control of appetite, interest, *etc.*"

This definition, together with the fact that all through his *Genetic Logic* he recognizes external control, relieves Baldwin of the reproach of ignoring so obvious an element of logical thinking. Still this leaves him in the inconsistent position of acknowledging that factor without giving it due weight in his dictionary definition of logic.

Incidentally it adds the weight of his authority to our contention for the existence and efficiency of external control.

As for the justice of excluding from logic spontaneous dyad inferences, two-term inferences, the reason for it assigned by Baldwin is clearly untenable. To exclude them for lack of subjective control, and to apply that test impartially, would exclude almost the whole of logic. The old logicians seem to have excluded them on the ground that they are not syllogistic. In the last analysis their reasoning was a *circulus in probando.* Direct dyad inferences are not logical because they are non-syllogistic. The syllogism is the universal type of reasoning because whatever is non-syllogistic is not truly logical. Reasoning in a circle is not very conclusive.[4] We shall have to search for better grounds than either Baldwin or traditional logic has to offer if direct interpretations of reality are to be permanently excluded from logic. Since these better grounds are not clearly in sight we make bold to regard spontaneous dyad inferences as logical. We are the more inclined to accept them when we consider the absurd consequences involved in their rejection. Inferring dirty weather from falling barometer would not be logical if I made the observation myself. I must have before me, and that accepted as true, the verbal *proposition,* "The barometer is falling," in order to proceed in the proper manner. Absurdities like this are among the grave consequences of setting up an arbitrary artificial standard of what is logical. I see the flash and hear the report of a gun, and see a man fall dead. I might think it was a case of murder. At the very least my inference would be homicide, whether or not it might be justifiable. My neighbor, a juryman, hears the same facts embodied in oral testimony, *verbal propositions,* and he thereupon draws the

[4] Some logicians who may admit that spontaneous two-term inferences are logical would no doubt claim that they are enthymemes, syllogisms in embryo, and proceed to *make up* a major premise for each of them. We wish them joy of that unique industry. The outcome of their labor of love might be something like this:

Every case of that peculiar grunt being heard is a case of a bear being somewhere about.

This is a case of that peculiar grunt being heard.

This is a case of a bear being somewhere about.

We are not quite sure that such labored results of that industry are wholly free from the easily besetting syllogistic sins, but aside from that, do they represent actual thinking? Even if it could be shown that civilized adults think in syllogisms, it is a far cry from the modern man in a frock coat to the naked troglodyte. In dim forests, himself hungry and beset with hungry beasts, quick and sure thinking was more to the point than triple-line syllogisms. That bear might pick his bones before he could make up a major premise. It is a common fallacy to project back into the initial stages of evolution features which belong only to its latest stage. We fear the cave man would turn in his grave if he were told that he must think like an Aristotle.

same conclusion. Is his reasoning any more logical than mine? Both are based on the same principle of cosmic order, the fatal effect of gunshot wounds. Both I and my neighbor are forced to believe as we do. It would defeat the ends of justice if jurymen assumed to control their own thinking in defiance of external physical control.

As a matter of fact first hand inferences are not only logical but better, sounder, more reliable than verbal implications, those pets of the old logic. The eye-witness has the whole situation before him and is able to shape his conclusions accordingly. If the victim had a loaded gun pointed at his assailant, we may infer justifiable homicide in self-defense. It is extremely difficult to bring out all the modifying conditions in oral testimony. Few witnesses have the faculty of accurate observation and lucid description. Memory is notoriously treacherous. All these handicaps to verbal implications weigh heavily against them. Our direct judgments and inferences arising spontaneously when confronted with a natural situation not expressed in words, are not only the most numerous but also have the greatest practical value for the guidance of conduct. Excluding them from logic is a gross waste of good logical material.

Now while we are insisting on the grave consequences of excluding dyad inferences from logic we must not ignore the fact that equally significant consequences follow from their acceptance as logical. But the advantage on the side of accepting them is this: In that case the consequences are beneficial. Notably the scope of logic is much extended. The current ordinary reasoning of mankind is chiefly of the spontaneous dyad type. So was that of primitive man; so is that of children, though both are normally logical in the just and rational sense of that term.[5] All this broad field of investigation, from the thinking of the cave-man to that of the philosopher, is fair game for the logician, and its diligent cultivation would make logic a live and growing science, a crowning benefit most desirable of all.

Notwithstanding the lack of sound reasons for their attitude, logicians who desire to conserve the old landmarks will doubtless continue to resist the admission of those wild cattle, spontaneous dyad

[5] Some authors, as we have seen above, may pronounce common-sense reasoning merely instinctive, not logical. That is a fad akin to the lordly air of the genus *Homo* towards other animals—his own ancestors, by the way. All signs of brute intelligence he simply labels *instinct* and lets it go at that.

Professor A. N. Whitehead, after stigmatizing common-sense thinking as moving by "blind instinct," so far forgets himself as to admit that the inference "mewing heard ∴ cat somewhere about," is a case of "deliberate ratiocination" (*The Organization of Thought*, p. 142). But this is a typical dyad inference, and "the man in the street" would handle it in precisely the same way as our eminent symbolist.

inferences, to the sacred precincts of their neat logical pinfold. They scent danger from afar; with good reason too, for normal logic is frankly revolutionary in its acceptance of dyad inferences as logical.

We do not claim originality for our definition of logic. Credit for it is due to Professor Royce. He used it in his excellent article in the *Encyclopedia of the Philosophical Sciences*. But Royce failed to grasp the full breadth and significance of its cosmic affinities, and he developed only the mathematical side of it. His exposition bristles with symbols and formulas.

We aim to develop the other side of normal logic, the every-day practical side. For this purpose we find algebraic symbols unnecessary, in fact not only unnecessary but confusing and hampering. Ordinary language is quite adequate for the expression of simple judgments and inferences. Many algebras of logic have been invented, very diverse and even hostile and contradictory; but they all agree in that they are ponderous, formidable, unwieldy. To use such heavy machinery for the expression of the simple judgments and inferences of ordinary logical thinking would be like setting up a powerful triphammer to drive a nail.

For a short answer to our initial query, What is logic? we may say that as a mode of mental activity it is simply sane, coherent, orderly thinking. Normal logic broadens the traditional conception of this science by emphasizing these three factors: (*a*) the existence and efficiency of external control, (*b*) a well-balanced twofold basis of reference both objective and subjective, (*c*) the sound logical quality and value of spontaneous dyad inferences.

II. Logical Criteria

How shall we know what is logical when we see it? The detailed analytical investigation, aimed at disclosing the essentials of logic in every one of its evolutionary stages, demands *criteria* to enable us to distinguish what is truly logical from that which lacks the essential logical marks. But in the mental sciences, just as in commerce, demand often outruns supply. Good logical criteria are rare. The old definitions will not serve our purpose. When we say that logic is the science of reasoning, our predicate is sadly in need of definition; and any good criterion of reasoning would also be a good criterion of logic. The definition is true enough, so true indeed that it is a truism. But like other tautologies it is worthless as a practical test of what is logical.

Many writers accept syllogistic form as a practical test of what is logical. But judgments are logical, though non-syllogistic. Also direct interpretations of reality are logical, though non-syllogistic.

This syllogistic criterion implies adherence to the traditional view that verbal implications alone belong to logic. The syllogism has a legitimate function as an *ex post facto* analysis of some of these verbal implications, but by no means as the sole and universal type of reasoning. Hence syllogistic structure is far too narrow in its scope to serve as a logical criterion.

Professor Baldwin specifies certain logical criteria which are well worthy of our consideration. On page 271, Vol. I., of his admirable work on *Genetic Logic* he says:

"It is, therefore, now not a difficult thing to express an opinion which we should expect to find fairly acceptable as to the logical criterion. If we are asking about the criterion of the function, it is simply that quite definite and unambiguous attitude of the mind, always indicative of judgment as act or disposition, ordinarily called Belief. If we, on the other hand, wish to know the criterion of the content of the logical, it is that relatedness which fulfils and motives theoretical interest. If, yet again, we are bent on inquiring what is the criterion of this mode of psychic life as a whole, that character which determines its place in the sequence of modes of cognition, we have to say that it is the dualism of subject and object, meaning by subject the 'I' that thinks and judges, and by object the 'me' or other thing that the 'I' thinks and judges about."

Belief, Relation, and Dualism of Subject and Object, are Baldwin's three logical criteria. The first is good as far as it goes; sane logical thinking commands belief. We believe our logical conclusions because we think they are true. True-or-false quality is a mark of what is logical. But while this acceptance with belief is a real logical mark it is not an exclusive mark. Many things which are alogical inspire belief.

Relation is more fundamental than belief. It is in fact the very bed rock of cosmocentric logic, so that it has been proposed to define logic as the science of relations.[6] Relation stands preeminent among the norms of cosmic order. Its great value is due to the fact that many relations are *constant* in human experience. Constancy of relations is the backbone of normal logic. The old logic based its universals upon the so-called *necessary connections.* These are at bottom the same as constant relations, but we prefer the latter name for them because all we really know is a certain fairly reliable degree of constancy. Necessary connection is an arbitrary assumption; reasonable constancy of relations is a matter of uniform human experience. For instance, we confidently assume that feline nature with all its faculties and attributes, accompanies the feline voice, and may

[6] *Cf.* Albert E. Avey, "The Present-day Conception of Logic," *Phil. Rev.*, XXVII., 4, p. 405.

be inferred from it when we hear mewing in the dark. And this we do because in our experience the cat is always there when we hear that note, not that there is any necessary connection between mewing and cats.

An illuminating side-light on the value of constant relations is obtained by comparing logical inferences based upon them with psychological suggestion, or association of ideas. Suggestion is free and easy, unfettered by any rigid control; it may fly wide and wild; any given thing may suggest any other. Inference based on a constant relation keeps to its plain beaten path. In suggestion there is no mental determination, no assertion, consequently no true-or-false quality. Inference implies a stand taken, a mental posture of assertion or denial, consequently something that may or may not be true. Suggestion adds nothing to our knowledge; it merely flings in one more item in the mad, seething, irresponsible flood of consciousness. Inference is cognitive; it makes a fresh and real contribution to our stock of knowledge.

But with all its excellence relation is too general for a logical criterion. It includes logical thinking and much more. Indeed it is questionable whether any sort of mental activity whatever can be mentioned which does not involve relations.

As for Baldwin's third criterion, subject-object dualism, that also is too broad in one sense, but in another sense too narrow. Once this dualism has arisen in consciousness it is present in substantially all mental activities; it is not limited to logical thinking. In that respect it is too general for a logical criterion. But from another point of view it is too narrow. It is a blanket which spreads away beyond the sleeper on one side and fails to cover him on the other side. In the history of mental development logical thinking begins earlier than clear recognition of "I" and "That." A child thinks truly and clearly about many things before he clearly distinguishes himself as a thinking subject. Just when subject-object dualism distinctly arises in consciousness is one of the most delicate and difficult problems in psychology. That fact alone condemns it as a logical criterion. A criterion ought to be plainer, more obvious, than that of which it is a mark. But here the contrary is true; we can discover logical thinking easier than we can determine the presence in consciousness of the dualism of subject and object.

It is interesting to note that Mansel regards subject-object dualism as a mark, not of logical, but of *psychological* judgment.

"Every operation of thought is a judgment in the psychological sense of the term, but the psychological judgment must not be confounded with the logical. The former is the judgment of a relation

between the conscious subject and the immediate object of consciousness; the latter is the relation which two objects of thought bear to each other.'' (*Prolegomena Logica,* pp. 54–55.)

Mansel is more hopelessly wrong than Baldwin. In common with the old logicians generally, he has in mind only modern adults, people like himself, in whom subject-object dualism has been long established. With such thinkers in mind he can well believe that each thought is accompanied by subject-object dualism, but for that very reason it is a bit of perverted ingenuity to set up that dualism as a distinction between logical and psychological judgment. His distinction is futile and needless for another reason. Judgment is one, not two. The psychologist may indeed ignore its logical function, viewing it exclusively from his special angle as part of the whole stream of psychic life which it is his business to describe; but that change of viewpoint does not change the thing viewed. Judgment is the same thing all the time, though one man may treat it psychologically and another handle it with a clear logical aim and method.

Mansel's logic, like all traditional logic, is a cross-section of logic in its latest stage only—a distorted cross-section at that. It is bound to be distorted because it misses the historical threads of logical evolution. Fully to comprehend the present we must always dig down into its antecedents. Baldwin's more rational method is that of a longitudinal section of logic, or at least a series of cross-sections at critical points of its evolutionary career. Fundamental conceptions of logic are radically modified in the light of this method. It goes far to modernize logic. Baldwin's *Genetic Logic* is a rich treasure-house of suggestions in the very line of progress which we consider most hopeful and fruitful for logical science.

Two additional marks of what is logical may be named, though, like those already mentioned, neither of them can be accepted as the single ultimate criterion. A very distinctive characteristic of normal logic is its cognitive efficiency. Judgments and inferences are the chief means of advancing in knowledge. We *know* that the day is windy when we see through the window waving branches of trees, though in the closed room we do not feel the wind. We *know* that the cat is somewhere about when we hear mewing in the dark. A constant relation would fail, cosmic order would be outraged, if that feline voice turned out to be produced by a puppy. This cognitive mark assumes special significance by contrast with the cognitive imbecility of syllogistic logic. Syllogisms add nothing to our knowledge; neither do the old immediate inferences. It is, however, true that judgments and inferences are not the only means of advancing knowledge. Hence cognitive efficiency is not the ultimate logical

criterion. It is a real mark of what is logical in the sense of that term for which we are contending, but it is not an exclusive mark.

Whenever thought becomes inferential it is logical. Smoke rises vertically and we expect fair weather. Our thought is inferential and therefore logical. But the trouble about this is that logicians do not agree as to what is an inference. For us inferential quality of thought is the best possible mark of what is logical, because we accept spontaneous dyad inferences as sound logical elements. But other logicians would enter a protest. Furthermore this mark fails of completeness. What it includes is verily logical, but it does not include all that is logical. Simple judgments are logical though not inferential.

On the whole it seems difficult, if not impossible, to hit upon any single infallible logical criterion. Now when the very best is unattainable, we must perforce be content with the next best. In the present case the next best would seem to be a *combination* of the best available single marks of what is logical. Logical thinking is based on constant relations, inspires belief, has true-or-false quality, advances knowledge, is orderly, coherent, harmonious with the environment. The concurrence of these marks constitutes a fairly reliable logical criterion, a criterion so obvious in its general trend that mankind at large has reached a pretty definite conclusion as to what is logical.

III. Logic and its Neighbors

Psychology is next neighbor to logic on one side, and epistemology on the other side. Since we have not found any absolute logical criterion, it goes without saying that we shall not be able to draw any hard-and-fast line between logic and its neighbors. Epistemology is the theory of knowledge, but logic also is cognitive. Both, therefore, involve the theory of knowledge, but with this difference: logic, like the other sciences, takes the possibility of knowledge as a postulate, while epistemology raises the fundamental question, How can we know anything at all? Logic takes it for granted that we can and do know things, and goes on from that postulate to trace the progress of knowledge and the organization of common knowledge into a system worthy of the name of science. In that sense it is a theory of knowledge and involves an epistemological element.

It also involves psychological elements in the sense that it handles much of the same matter as psychology. Both deal with mental activities, but with a different aim, and a different method. Psychology is broadly descriptive, logic primarily functional, just as anatomy describes the bodily members while physiology is concerned with their functions. Judgment and inference are the special functions

characteristic of logic. They serve in a general way to characterize it, but though distinctive they are not absolute and exclusive distinctions. Both judgment and inference touch upon the theory of knowledge, and both of them may be treated psychologically. Thus at every turn we are baffled in the attempt to delimit logic with severe strictness. In fact ordinary thinking—still more primitive thought—is all very much of a piece, undifferentiated by those sharp distinctions erected by modern analysis.

A short cut, an easy method, albeit an arbitrary and unfair method, of delimiting logic, is to label everything psychological that has about it any shadow of doubt. In the minds of symbolists and logicians of the old school, that will be the fate of our direct interpretations of the environment. A bare glance at the actual genesis and subsequent course of logical evolution ought to be an effective rebuke to that shorthand method. The cosmos itself is logical, and minds, both brute and human, evolved under the steady pressure of cosmic order, naturally contain the essential elements of logic *ab initio*.

The fact that we are not able to delimit logic with sharply defined boundary lines need not distress us, for that is the actual status of all sciences, and of subordinate groups within each science. It was only the pre-Darwinian naturalists who had the privilege of dealing with immutable species bounded by absolute distinctions. Darwin opened the floodgates and set everything adrift. Your modern biologist is content with *types*. The high light on the type shades off into a penumbral zone overlapping the penumbra of the next neighbor. So it is with logic. The logical type is inference, but it shades off into judgments and concepts, and these may, of course, be treated psychologically.

There is one consideration which goes far to justify the old claim of logic to be *Scientia Scientiarum*. Every science must be developed logically. This brings logic into intimate relations with all of the sciences. But the old claim of logical primacy receives nothing but contempt so long as logic is taken to be traditional syllogistic. To claim that every science must be developed in formal syllogisms would verily deserve contempt. But in sober truth logic is the science of sciences when its real character is recognized as being marked by thinking that is sane, orderly, coherent, and in harmony with the environment. Every science must be developed by that sort of logical thinking.

Another old notion the justice of which depends on whether logic is modernized, is its function as a propædeutic to philosophy. Traditional logic has small claim to that honor, but a rejuvenated logic

may regain the old pedagogic relation to philosophy and metaphysics. That a sound logical training would be an advantage to philosophers is evident from the fact that some current philosophies would clearly be improved by being more logical. On the other hand, none of them would be improved by being more syllogistic.

Philosophy and metaphysics need the friendly aid of logic more directly than other sciences. According to Professor Hobhouse the very heart of the rational cosmos, "the ultimate justification of thought and experience," is to be found "in its character as a coherent system, a whole in which the diverse parts support and necessitate one another." (*Mind in Evolution*, p. 371.) Now the nexus of a "coherent system" is logical. Philosophy and metaphysics which treat of the whole rational cosmos, are, therefore, grounded on logic in a sense more profound than that which requires for them, as for other sciences, logical precision in their development.

IV. Static Order and Dynamic Order

The conception of logic as cosmocentric may be repugnant to some persons on the ground that it seems to them to be a surrender to naturalistic or mechanistic philosophy. Are we not in danger of losing some precious inheritance of humanity by boldly accepting cosmic order as the basis of logic, instead of adhering to the laws of human thinking with all their delicate and exalted refinements? Is it quite safe to abandon the comfortable old anthropocentric homestead and trust ourselves wholly to cosmic influences?

For the comfort of such persons we may say, in the first place, that the cosmic order on which normal logic builds includes all the refinements of human thinking. Every actual, solid and permanent achievement of mankind, whether in science, philosophy, art, literature, poetry or religion, is part and parcel of cosmic organization. By its cordial recognition of these human elements normal logic becomes strictly neutral as between naturalism and idealism. It is truly a natural system in that it banks on actual conditions, but it gives due weight to each and every one of nature's constituent elements, mental and spiritual as well as material. As a slight hint that it is not likely to foster partiality to naturalistic philosophy, or hostility to idealism, though it is a natural system, it is interesting to note that Baldwin's *Genetic Logic*, a system more akin to normal logic than any other now before the public, ends up with *Pancalism*, the doctrine of the *All Beautiful*. Also it is noteworthy that idealism and naturalism are approximating so nearly that some philosophers would themselves be puzzled to say on which side of the line they belong.

In the second place we may point out the salient fact that the actual organization of the cosmos, apart from its human element, is both mechanical and teleological. There is on the one hand Static Order, orderly arrangement in itself and for its own sake, and on the other hand Dynamic Order, orderly arrangement with reference to specific results. The joint effect of these coexisting and interacting phases of cosmic order is an admirable combination of stability with flexibility. So long as normal logic truly reflects cosmic organization, it is not in any danger of being swamped in mechanism. If it ever hardens into a rigid formalism it will not be by following nature but by ignoring those adaptations which give infinite variety and plasticity to nature's products.

A familiar illustration of fundamental order-types and their modifications to fit them for special conditions, is found in the lateral appendages of vertebrates. The essential elements in the type of a vertebrate limb are these: first one bone, then two bones side by side, then a bunch of small bones, then five bones side by side, and finally five digits. This combination prevails so widely, and is so often realized in animals extremely unlike in other respects, that naturalists have no hesitation in accepting it as a type and describing its elements with all the minuteness and positiveness which belong to the description of real things. It *is* a real thing, a real norm of cosmic order, a norm which defined the fundamental lines in the pattern of your arm, the eagle's wing, the lion's paw, tracing them out all from the same archetypal model.

But how does nature handle this type? Instead of holding to it as a rigid inflexible pattern, she plays all sorts of tricks with it, spreads it out as a paddle for swimming or a wing for flying; swings a digit about as a thumb for grasping; lops off a digit here or a pair of them there, finally, in the foot of the horse, dropping all but one in the rage for concentration and solidarity. In short nature takes no end of liberties with the general type, treating it as a sort of convenient platform on which to stage her everchanging play of special ends, trimming it down or stretching it out just as the act in hand may require. Thus does nature achieve both stability and flexibility by the constant interplay of static and dynamic order.

We often see the terms *order* and *adaptation* paired off and used as if they were equivalent to static order and dynamic order.[7] This is inappropriate; it implies a contrast which does not exist, *viz.*, that

[7] A suggestion for our use of the terms static order and dynamic order is due to Howard C. Warren in his article "Mechanism versus Vitalism," *Phil. Rev.*, XXVII., 6, p. 614. His usage, however, is not exactly the same as ours. He speaks of static and dynamic *harmony*, and he limits the former to physics and chemistry. We consider static order to be universal.

adaptation is, or may be, disorderly. As a matter of fact variations with reference to specific conditions are eminently systematic. Otherwise how could a Cuvier or an Owen reconstruct the whole extinct animal from a single bone? Adaptation is orderly, though its teleological aspect introduces a new conception of order which justifies the distinctive adjunct, *dynamic*. Teleology is broad enough in its meaning to cover the whole field of adaptations, both in biology and in nature at large. We use it in the strict scientific sense to designate actual adaptations to specific conditions. Its use—or abuse—in natural theology is quite another affair.

Teleological relations have a very reliable degree of constancy; judgments and inferences based upon them approach about as near to ideal certainty as human reason can usually attain on any other grounds. Thus the logical value of teleology is twofold; it makes a direct contribution to the number of reliable logical constants, and it serves as a safeguard both of philosophical neutrality and against ultraformalism, a safeguard which is effective so far as nature's wholesome example can be effective. A logic characterized by mechanical rigidity stubbornly persisting in the face of prolific and flexible modifications of order-types, must at any rate forfeit all claim to be a natural system.

Logical constants are, however, for the most part based upon static order. Nearly all, if not all, of our examples already cited would come under that category. The old theologians might indeed see a purpose in the relation, steam—boiling water, but it would be a fanciful purpose like Derham's alleged function of volcanoes as warnings of hell-fire. Static order is first in logical priority and first in importance. It is the solid cornerstone of the logical superstructure.

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A NEW CONTENT COURSE IN PHILOSOPHY[1]

I HAVE had some difficulty in devising a title for this paper. I thought at first of calling it "Neo-Positivism," and then it seemed that "Neo-Synthetic Philosophy" would meet the situation better, but further reflection indicated that each was too ambitious. I decided, therefore, to adopt the modest title that has been announced, although some perhaps may object that it is not strictly a content course, while others may deny that it is new, and still others that it is philosophy at all. Both objections and denials are prolific

[1] Read at the meeting of the Western Philosophical Association at the University of Wisconsin, Madison, Wis., April 17, 1920.